Lesson: Measures of Central Tendency

STANDARDS ALIGNMENT
- Grade 6: CCSS.Math.Content.6.SP.B.5c
- Grades 6–8: NCTM Data Analysis and Probability

OBJECTIVES:
Students will be able to:
- Define and calculate mean, median, mode, and range;
- Construct data tables that facilitate the calculation of mean, median, mode, and range; and
- Determine which measure of central tendency is best to use in a given circumstance.

Time Required: 40 minutes, plus additional time for worksheets (may be split over two or more days)

Materials: Worksheets 6.1, 6.2, and 6.3

DIRECTIONS:
1. Pose the following problem to your class: You have been offered a sales job at Trixie’s custom bike shop. There is no salary, but you are paid a 10% commission on every bike you sell. You ask Trixie what the typical sales rep makes. She isn’t sure, but she provides you with the amount of commission paid to each of the seven sales reps for the past week: $500; $1,000; $50; $11,000; $950; $50; $450. Write these amounts on the board.

2. Ask the class what they think the typical sales rep makes and have them explain their thinking. Through the discussion, ensure that the following points are made:
   - That week, the lowest-paid rep earned $50 while the highest made $11,000. This is known as the range. Indicate that range can also be shown as the difference between the greatest data value and the lowest data value. In this case, $11,000 – $50 = $10,950.
   - The mean commission equals the sum of the commissions divided by the number of sales reps. In this case, $14,000/7 = $2,000. Note that mean is sometimes called arithmetic average.
   - The mode commission is the amount that appears most often (there may be more than one). In this case, $50 is the mode because it appears twice while all the others appear only once. (One way to remember mode is that the initial letters of “most” and “often” are the first two letters of mode.)
   - Demonstrate how median is determined. Line up the amounts in ascending order, i.e., $50, $50, $50, $500, $950, $1,000, $11,000. Indicate that $500, the middle amount, is the median. (One way to remember median is that the median on a highway runs down the middle.) Point out that when there is an even number of data points, calculate the mean of the two middle numbers to find the median.

3. Ask the class whether the mean ($2,000), median ($500), or mode ($50) would best represent the “typical” weekly commission. Ensure that students understand that the two $50 amounts and the one $11,000 amount skew the mean and median, respectively.

4. Discuss the advantages and disadvantages of each measure. Note that the mode, which is easiest to calculate, is useful in certain circumstances, for example when a sandwich shop wants to find out its most popular sandwich, but is less useful as a measure of what is typical. The mean—which, unlike the median, doesn’t require the data to be lined up in order—is subject to being skewed by unusually high or low values.

5. Distribute Worksheets 6.1–6.3 to students over 1–3 days, then review answers with the class.

Worksheet 6.1: “Veggie-Tables”

1. Sweet Potato Variety Tons per Acre Harvested by Farm
   - Terrific Taters 3, 6, 11, 11, 19, 27, 34
   - Terrific Taters range: 24 (34 – 0)

   NOW TRY THIS: The two farms reporting 3 tons and 34 tons would not affect the range because these results are within the current range. The farm reporting 0 tons would increase the range from 31 to 34 (34 – 0).

Worksheet 6.2: “Those Are Some Mean Brussels Sprouts!”

1. First, rearrange the data in ascending order:

<table>
<thead>
<tr>
<th>Brussels Sprouts Variety</th>
<th>Yield per Acre (in Pounds)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgian Boy</td>
<td>0; 200; 200; 600; 1,200; 1,500; 1,595</td>
</tr>
<tr>
<td>Green Goddess</td>
<td>400; 450; 700; 850; 900; 1,200; 1,600</td>
</tr>
<tr>
<td>Jade Giant</td>
<td>200; 300; 500; 500; 700; 1,200; 1,200; 2,600</td>
</tr>
</tbody>
</table>

2. Although Jade Giant has the highest mean, Green Goddess has the highest median and is the better choice. Jade Giant’s mean is skewed by one large result.

   NOW TRY THIS: 905 pounds (800 x 8 = 6,400. Prior mean of 785 x 7 = 5,495, 6,400 – 5,495 = 905.)

Worksheet 6.3: “Stuck in the Middle”

1. Vegetables Mean Median Mode
   - Daikon Radishes $250 $250 $250
   - Sweet Potatoes $350 $375 $500
   - Baby Arugula $375 $450 $none
   - Heirloom Rutabagas $300 $100 $100

   2. Median would be the best measure to use because the onetime order of $1,200 inflated the mean.

   3. Sweet potatoes and baby arugula have the highest median sales.

   NOW TRY THIS: The range for sweet potatoes = $400 while the range for rutabagas = $1,100. This indicates that there is more variability in the sales of rutabagas and greater dependability in the sales of sweet potatoes, especially since median sales are higher for sweet potatoes.

For Online Materials, Visit: www.actuarialfoundation.org/cultivatingdata